PROJECT facts

U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

High Efficiency Engines and Turbines

12/2002

THE STAGED PREVAPORIZING-PREMIXING INJECTOR: HIGH PRESSURE EVALUATION

PRIMARY PARTNER

University of Washington

TOTAL ESTIMATED COST

$ 104,310

CUSTOMER SERVICE

800-553-7681

STRATEGIC CENTER FOR NATURAL GAS WEBSITE

www.netl.doe.gov/scng

Description

Under the Advanced Gas Turbine Systems Research (AGTSR) program, the University of Washington (UW) will evaluate at high pressures a pre-vaporizing/pre-mixing fuel injection approach for reliably achieving low emissions with liquid fuels. Task 1 redesigns and modifies an existing dual fuel injector for full scale testing at high pressures representative of turbines. The injector (shown in Figure 1) has previously shown promising performance in tests at atmospheric pressure. The engineering staff at Parker Hannifin (a commercial supplier of turbine fuel injectors) will provide advice and engineering evaluations for the redesign of the injector. Task 2 evaluates the engine scale injector at pressures above 11 atmospheres in a test rig at Solar Turbines. Prior to the pressurized runs, tests are also conducted at atmospheric pressure and the same injector residence time as for the pressurized tests to measure the completeness of fuel vaporization and premixing, emissions performance, and combustion oscillations. Task 3 conducts computer analyses to assist in interpreting and understanding the injector data and injector/combustor interactions.

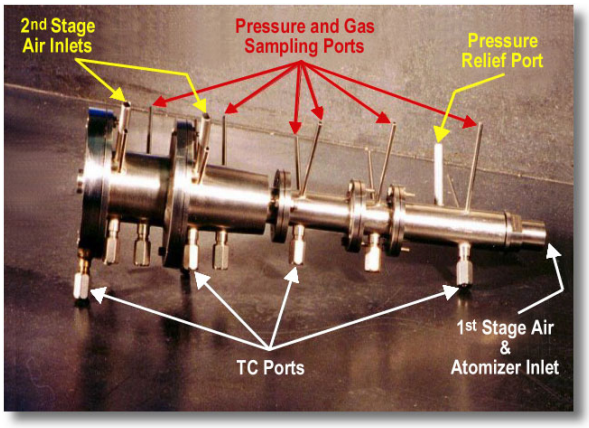

Figure 1. Pre-vaporizing/pre-mixing injector for liquid fuels

The Staged Prevaporizing-Premixing Injector: High Pressure Evaluation

CONTACT POINTS

Tom George
National Energy Technology Laboratory
P.O. Box 880
3610 Collins Ferry Rd.
Morgantown, WV 26507-0880
304-285-4825
tgeorg@netl.doe.gov

Richard Dennis
Product Manager,
High Efficiency Engines and Turbines
National Energy Technology Laboratory
P.O. Box 880
3610 Collins Ferry Rd.
Morgantown, WV 26507-0880
304-285-4515
richard.dennis@netl.doe.gov

Richard Wenglarz
South Carolina Institute for Energy Studies
386-2 College Ave.
Clemson, SC 29634
864-656-2267
rwnglrz@clemson.edu

Professor Philip Malte
University of Washington
Mechanical Engineering Department
Box 352600
Seattle, WA 98195
206-543-5486
malte@u.washington.edu

Duration

24 months

Goals

Commercial low emission turbine combustors utilize fuel lean premixing with air upstream of the combustion process. Initial versions of low emission combustors have been designed for operation with natural gas fuels. With increasing uncertainty in natural gas fuel prices, capability to operate low emission turbines with liquid petroleum fuels has become increasingly important. However, the need to pre-vaporize liquid fuels without premature ignition and possibilities for liquid fuels to coke on injector walls present additional challenges over those for natural gas fuels to reliably achieve low emissions. The goal of this project is to test and evaluate at turbine high pressures a novel, industrial scale, prevaporizing/pre-mixing injection approach that has shown promise at atmospheric pressure.

Benefits

Successful verification of the staged, pre-vaporizing/premixing concept at turbine high pressures will provide data and an approach to assist turbine engineers in the future design of liquid fueled, low emission combustors.